All contributions to be sent to the Editor, 19 St. Andrew's Mansions, Dorset Street, W.1. (Telephone, Welbeck 9631.)

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EDITORIAL

THE STRUGGLE UPWARD

WHEN the anæsthetist of to-day in England compares his professional position with that of his predecessors, he finds much for which to be grateful. At the same time he is aware that there is much to be desired and striven for. It is not many years since the man who was professionally an anæsthetist and nothing else, had few rewards and little status. In hospitals he was not a member of the honorary staff, and seldom on the committee of the medical school, and in private his fees were small and completely at the surgeon's nomination. To-day, in all these respects, he is better off. At most teaching hospitals he is on the medical committee, and is either on the honorary staff of the hospital or, if not, is receiving most of the privileges of those who are. Outside the hospital his rewards are greater than they were and are often named by himself, or after consultation with him. His speciality is recognized by the institution of a diploma granted, after examination, by the Royal Colleges, and his status as a specialist has been specifically recognized by the British Medical Association. Also the Association which the anæsthetists have formed for themselves has made and is making successful efforts to advance the justifiable claims of the anæsthetist as regards position and remuneration.

There is one aspect of the anæsthetist's desire for im-

proved status which is not as widely attended to as it deserves to be by the working anæsthetist. We refer to the question of academic degrees. Before the anæsthetist can effectively claim equality on hospital staffs and elsewhere with his colleagues, the physician, surgeon, and specialist, he must make sure that he is at least on a par with them as regards qualifications. On the medical and surgical sides no man expects to be considered eligible for a teaching hospital staff if he is not at least M.R.C.P., M.D., or F.R.C.S. There are still plenty of anæsthetists who hold none of these degrees and are yet dissatisfied with the recognition which they have received by the institutions that they serve. This is a state of affairs that the rising generation of anæsthetists will surely remedy.

There is another aspect of his work which the ambitious anæsthetist is apt to forget or ignore. In the nature of things his activities are almost always secondary. Only in rare instances is the taking of an anæsthetic the main therapeutic measure. Ninety-nine times out of a hundred the anæsthetic is taken in order that an operation may be performed. It is, therefore, only natural and logical that the surgeon should be the principal actor, although it is true that the better informed he is, the more does he treat the anæsthetist as a colleague to be consulted rather than as a subordinate to be directed. This treatment applies to examination before and management after operation as well as to the operation time itself.

There is certainly one aspect from which the importance of the anæsthetist at the operation rivals or exceeds that of the surgeon. This is the life-saving aspect. It is for the anæsthetist to note the approach of danger and to institute measures to defeat it. Moreover, it is the anæsthetist himself who is handling a deadly weapon, and it is only by his knowledge and skill that anæsthetics act as beneficial aids to operation, instead of as mortal enemies of the sick man.

There are, it appears to us, two great defects in the present system of medical practice which must be remedied before the full benefits of anæsthesia can be enjoyed as they should be. The first is educational and the second

is the position and scope of the specialist anæsthetist. Adequate education in anæsthetics at the present time is an extremely difficult problem. The difficulty arises from several sources. Perhaps the chief one is the fact that the teaching hospital anæsthetist is, most of the time, by his obligations to patient and to surgeon, obliged to use methods and machines which will not be in the hands of the future general practitioner, i.e., the student whom he is teaching. The consequence is that the average student goes out into practice less well equipped to give the occasional anæsthetic which is almost sure to fall to his lot than was his predecessor of one or two generations ago who had been educated in the simpler methods which then were alone in vogue and which are still, generally speaking, the only methods available for the general practitioner. Of course some will say, "The fewer anæsthetics left to the general practitioner the better," and it is admitted that the ideal state would be that in which every anæsthetic was administered by an expert. That is, however, not practically possible. Taking the country as a whole there are not, and cannot be in present circumstances, anything like enough experts to go round. What is the answer to the problem? In our opinion it lies in better education of the student in anæsthetics, which can be achieved only by allowing more time for this subject than it has hitherto received. If every student had to give up one month during his third clinical year solely to the study and practice of anæsthetics much would be gained. With the popularity which the D.A. has attained we should reach a point at which, in every fair-sized town at least, there could be found several anæsthetists competent to undertake the anæsthetic for any proceeding whatever, and it should be the surgeon's duty to see that they, and they only, were asked to give anæsthetics for major operations. Much of the work out in the country proper would continue to be done by the general practitioner; under our scheme, at any rate, competent to give a safe if simple administration.

Improvement all round in the specialist anæsthetist's position requires firstly, as we have hinted, that he shall

always be of the professional calibre of his surgical and medical colleagues. The second desideratum is that he should be able to carry out a large amount of hospital work and teaching without thereby hopelessly endangering his livelihood. This means one of two things, either his pay from hospital must be something far in excess of what it is at present, or else his fees in private must be much higher than they now are. In the present conditions it is difficult for the specialist anæsthetist at his hospital to do more than give and supervise anæsthetics. He has not time and is not encouraged to prosecute research or to organise proper recording of the work that is done. This almost complete absence of clinical records of anæsthesia means a wastage of vast amounts of material which, properly used, could do much to advance knowledge of the subject.

So little importance is attached to this matter that if the anæsthetist tries, at the sacrifice of time and trouble, to amend matters at his own hospital, he may meet with the same obstructive non-co-operation on the part of the rest of the staff as befell the anæsthetist at a teaching hospital in London. His efforts were so ill received that in despair of the position in this country he transferred his activities to the United States where certainly, in some hospitals at least, there is proper encouragement and organisation of truly scientific study of the practice of anæsthetics.

Since Lord Nuffield's entry into the field with his splendid donations to Oxford, a portion of which was set aside for anæsthesia, we may well hope that the worst days are over, and that the study of anæsthetics in Great Britain may, in the not distant future, receive the encouragement and practical support which its importance so indisputably demands.

OBSERVATIONS ON INTRA-CRANIAL PRESSURE DURING GENERAL ANÆSTHESIA

BY

F. W. G. SMITH, M.A., M.D., M.Ch., D.P.H., D.O.M.S.

Ophthalmic Surgeon, East Ham Memorial Hospital; Ramsgate Education Committee.

Acting Squadron Leader, R.A.F.O.

WHILE undertaking some investigations into the possible causes of convulsions under general anæsthesia, in which increased intra-thecal pressure has been observed, it was thought that a study of the intra-cranial pressure, estimated by the method employed by Baurman,[1] Sobánski[2] and others, of a number of patients under general anæsthesia might be of interest.

Gibbs[3] has confirmed the experiments of Baurman and noted that, when the intra-cranial pressure exceeded the intra-ocular pressure and the basic pressure of the retinal veins, the retinal diastolic venous pressure varied almost directly with the intra-cranial pressure when the latter was above 18 mm. Hg, until the retinal arterial pressure was reached.

Lauber,[4] quoting Sobánski, has recorded that when the ratio of retinal venous pressure to retinal arterial pressure was nearer than 1:1.5, papillœdema was likely to occur, and that when the intra-cranial pressure was above normal the retinal diastolic arterial pressure was raised although the systemic blood-pressure might be normal. The latter fact had been observed by Bailliart,[5] who, in addition, stated that, where there is a spontaneous retinal venous pulse, the venous pressure approximated to the intra-ocular pressure.

In the present investigation, estimations of retinal dias-

tolic venous and arterial pressure, as gauged by the pulsations of retinal vessels, and the intra-ocular pressure, were taken on ten controls, in whom four-per-cent cocaine was the only anæsthetic used, and 42 patients in the third stage of general anæsthesia; the operation having been in progress for 15 to 20 minutes. In lengthy operations, a second series of observations were taken towards the end of the operation. These second readings showed a fall of retinal diastolic arterial pressure only, in some cases. A Bailliart's ophthalmo-dynamometer, with button stop, and a Schiotz tonometer were used. Duke-Elder[6] has pointed out the errors arising in this form of tonometry but, as the same instruments were used, the relative error should have effected both controls and cases equally. In clinical use a reading of 25 to 28 mm. Hg in this particular Schiotz was considered normal when no signs or symptoms of glaucoma were present. This would tend to make my results slightly high.

The relations of the individual pressures to each case are shown in the chart (Fig. 1) and a summary of the observations in Fig. 2. It will be noticed that there is some variation in pressure standards recorded by different workers; careful readings with this particular ophthalmo-dynamometer in only a few instances gave readings as low as Bailliart's.

In the case of the controls there was a tendency to breath-holding and some excitement which would heighten some of the readings. Macdonald[7] observed the intrathecal pressure rose to 500 to 600 mm. H_2O in patients who struggled. The majority of the patients were males in the 20 to 30 age group. Systemic blood-pressure and the intra-ocular pressure, etc., were found to be normal, when taken after the anæsthetic, in those cases which had shown high readings.

These observations show that, on the average, the intracranial pressure was increased by 6.7 mm. Hg, the intraocular pressure by 5.6 mm. Hg and the retinal diastolic arterial pressure by 15.5 mm. Hg in patients under a general anæsthetic; the controls conformed to accepted standards. The greatest average rise of intra-cranial pres-

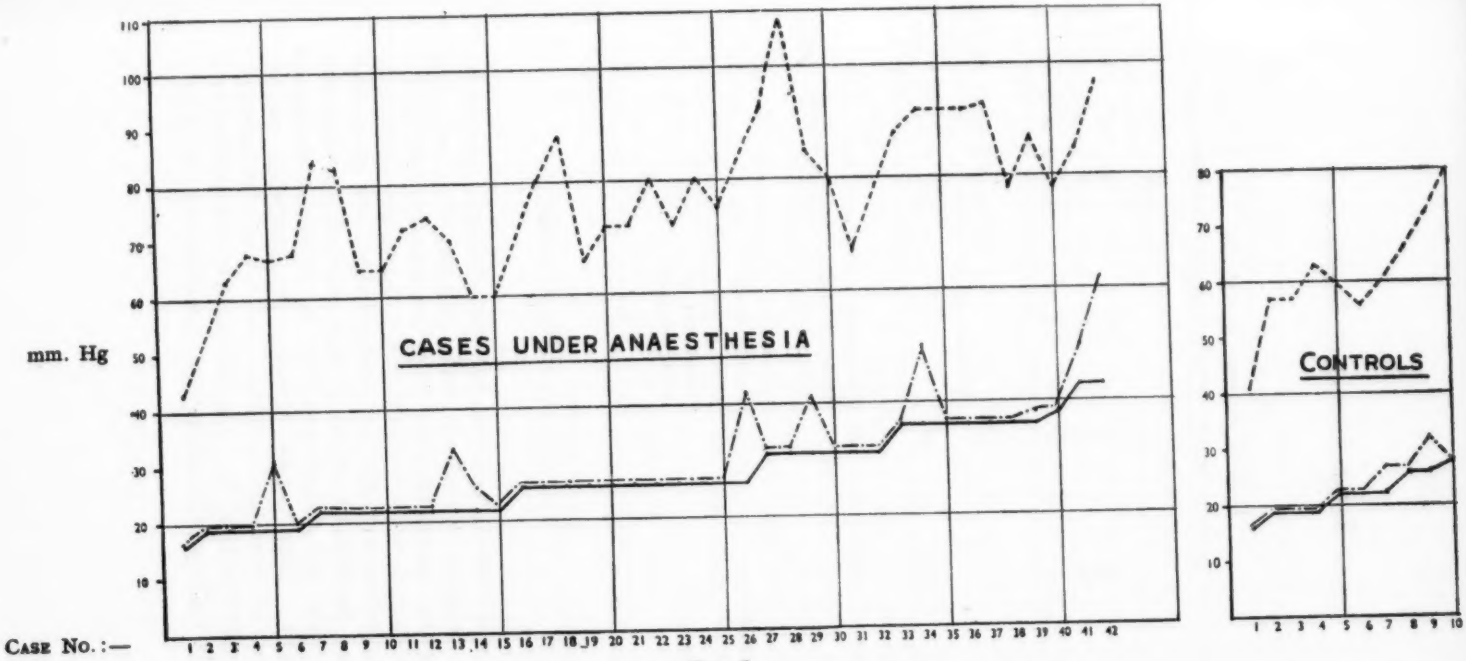

FIG. I.

Retinal Diastolic Arterial Pressure – – – – –
Retinal Diastolic Venous Pressure –·–·–·–
Intra-ocular (Schiötz) Pressure ————

FIGURE II

Table of pressures in mm. Hg

	Average	Lowest	Highest	Published standards	Ethyl chloride and open ether	N_2O, O, and ether*	N_2O, O, and ether intra-tracheal†
Intra-ocular pressure 42 cases	27.5	16	43	All ages, 15–25	Average for 8 cases 27.5	Average for 16 cases 27.2	Average for 18 cases 27.8
10 controls	21.9	16	28				
Retinal diastolic venous pressure 42 cases	29.9	16	62	Macdonald Sobánski 16–23 Bailliart 18–25	27.5	29.1	31.3
10 controls	23	16	32				
Retinal diastolic arterial pressure 42 cases	76.8	43	108	Parsons 60–70 Bailliart 30–35 Macdonald 54 Sobánski 40–48	85.8	71.0	78.7
10 controls	61.3	41	80				

* Boyle's machine.

† Boyle's machine and Magill's tubes.

sure was in those cases who had intra-tracheal anæsthesia; these patients had nitrous oxide and oxygen chiefly and little ether; hence, despite a more free air-way, they tended to conform to what is considered usual in gas anæsthesia. A case which had ethyl chloride induction and open ether showed the highest retinal diastolic arterial pressure, and one, under gas and oxygen only, the highest intra-cranial pressure. Three cases induced by pentothal sodium showed all readings definitely lower than the average; those premedicated by opium derivatives and atropin were mainly higher. The intra-ocular pressure rose to 43 mm.

Hg in two cases under nitrous oxide, oxygen and ether, and to 36 mm. Hg in one case under ethyl chloride and ether.

Intra-cranial pressure during anæsthesia has been studied by Roy and Sherrington[9] who showed there was marked expansion of the brain in dogs under ether; Forbes[10] found marked dilatation of the pial arteries and vessels of the brain in cats under ether. Myerson and Loman[11] noted that in man inhalation of ether raised the C.S.F. pressure from 140 mm. H_2O to 250 mm. H_2O.

Morphia, in larger doses, tended to raise intra-cranial pressure. Butler[12] and Horsley[13] found that barbiturates caused a fall of pressure in man. The literature is summarised by Beecher[14] who states that observers do not agree as to the effect on intra-cranial pressure of barbiturates and avertin but that ether, chloroform, and more especially nitrous oxide, cause a rise; he considers anoxia may play a part in the latter case. In cases where there is already increased intra-cerebral pressure the additional strain, as a result of employing a general anæsthetic, must be considered seriously.

It is possible, also, that a sudden rise of pressure in a normal brain might lead to untoward results when the central nervous system is under the influence of a general anæsthetic.

It is suggested that intra-cranial pressure during anæsthesia may be estimated, approximately, by anæsthetists in a simple manner in cases where they consider this advisable, i.e., septic, dehydrated, cerebral or renal conditions. They should observe with an electric ophthalmoscope whether spontaneous retinal venous pulsation was present, or whether light pressure on the eyeball through the lower lid by the finger was required to produce this. The tension of the eyeball should then be estimated by finger pressure or by the sight and sense impression afforded by producing a slight dimple on the eyeball with a glass rod. (T. W. Letchworth.)

Where the eyeball was obviously softer than normal, this test would be of no consequence unless comparatively

severe pressure was required to produce venous pulsation. The intra-cranial pressure might be considered to be within normal limits when:

(i) Spontaneous retinal venous pulsation was present.
(ii) Intra-ocular pressure apparently normal.
(iii) Gentle pressure on the eyeball would not produce a venous pulse.

Baurman's methods might be adopted in the study of headache following spinal anæsthesia.

Summary

Some of the literature on intra-cranial pressure is discussed. Observations by the method of Baurman have been made on 42 patients under general anæsthesia and ten controls. A simple means of approximately gauging intra-cranial pressure during anæsthesia is suggested.

I am indebted to Wing Commander T. J. Thomas and the medical and nursing staff of a Royal Air Force Hospital for their kindness and aid in helping me to carry out this work, and to the Air Ministry for permission to publish this paper.

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ANÆSTHESIA IN SURGICAL SHOCK

BY

E. M. CHIVERS, D.A., and W. E. F. EVANS, D.A.
Assistant Medical Officers, West Middlesex Hospital.

THE following observations on the reaction of shocked patients to varied types of anæsthesia represent merely the personal experience of the writers during the last five years, and particularly during the more recent months.

From the anæsthetist's point of view shock may be defined as a condition of acute depression of the respiration and circulation, and as such presents a combination of factors producing anoxaemia of the tissues. Patients in this state are unsuitable for operation and, whenever possible, treatment is postponed until the condition improves. Recent advances in chemotherapy have made it safer to delay operation than was previously the case, but there is a large number of patients who require immediate operation, and who therefore will require pre-operative measures to improve the general condition.

Treatment consists of:

(1) Rest.
(2) Relief of pain.
(3) Warmth.
(4) Fluid replacement.
(5) Stimulants.

The question of fluid replacement is one of some importance to the anæsthetist as three factors may have been responsible for the original loss, and replacement should be carried out in accordance with the resultant blood picture, otherwise too concentrated or too watery blood may result. The following table shows roughly the various conditions:

Cause of Shock	Treatment Suitable
Bloodless injury with fluid loss into tissues.	Intravenous injection of concentrated solution of dried serum.
Lacerations with gross blood loss whether internal or external.	Whole blood transfusion.
Combination of bloodless injury with blistering or other fluid loss as in burns.	Dried serum as in first case but not in concentrated solution.

Premedication. The disadvantages of morphia are more than counterbalanced by the relief of pain afforded. Omnopon gr. 1/3 with scopolamine gr. 1/100 is a good routine mixture and may be reduced if necessary. Should the patient have had a recent injection of morphia on account of pain it is sufficient to give the scopolamine alone.

The barbiturates and bromine-containing basal anæsthetics are all respiratory depressants and are, therefore, to a certain extent contra-indicated. When used the doses should be smaller than those normally given (see below).

Choice of anæsthetic. The anæsthetic has to satisfy the following four requirements:

(1) To prevent further shock.

(2) To abolish pain.

(3) To enable the surgeon to proceed without muscular resistance.

(4) To offer the minimum of toxicity.

All anæsthetic reagents are toxic and should, therefore, be used in the smallest possible quantities consistent with the first three requirements. Five main methods may be considered:

(1) *Local analgesia.* Except for scalp wounds and for the reduction of minor fractures there are few occasions in which local infiltration is of use in traumatic surgery. The presence of local contamination is an absolute bar. When

used, the solutions should be weak, i.e. novocaine half per cent or one per cent, percaine 1/200.

(2) *Regional analgesia.* This provides excellent relaxation and nerve block is useful for injuries of the leg or chest, but not so satisfactory in the arm on account of these patients usually being restless, and because complete brachial block requires rather a large amount of novocaine, 25 c.c. to 30 c.c. of two per cent solution.

(3) *Spinal analgesia* is not suitable for patients already shocked, and should not be given unless the systolic pressure is over 100 mm. Hg. In perforating abdominal wounds caused by missiles it is most unsuitable for the following reasons:

(*a*) High spinals reduce blood-pressure still further.

(*b*) The internal injuries may be far more widespread than is apparent from without, and what was at first expected to be a pelvic operation may become high abdominal or even thoracic.

(*c*) It may be found necessary to tilt or rotate the patient, and these movements do not improve the general condition.

(4) *Intravenous barbiturates.* These drugs have many advantages, and give excellent results when used in moderation. They are easy to administer, and provide a pleasant and rapid induction; give good relaxation and require the minimum of apparatus. There are, however, the following disadvantages:

(*a*) Where veins are collapsed they are not easy to enter, and in restless patients it is easy for the needle to become dislodged during the injection.

(*b*) Shocked patients are more susceptible to these drugs than are healthy patients, even so small a dose as 0.20 grams of pentothal given in five per cent solution has been seen to produce extremely deep narcosis.

(*c*) There is further respiratory depression with consequent increase of anoxaemia.

(*d*) Resulting from (*c*) there appears to be an increased incidence of post-operative pulmonary complications as compared with similar cases given simple inhalation anæsthetics.

(*e*) Theoretical unsuitability of sulphur-containing drugs in patients who are candidates for some form of sulphonamide treatment.

Intravenous barbiturates should be given slowly through a fine needle, and on no account should any standard dose be adopted, but each case watched closely throughout the induction. As soon as the patient loses consciousness the jaw must be supported and an airway inserted. As stated above, the tolerance for these drugs is considerably reduced in shock, and the rate of elimination is also reduced. Oxygen may be indicated if there is cyanosis. Picrotoxin and coramine are good analeptics.

(5) ***Inhalation anæsthesia.*** Nitrous oxide is unsuitable alone, but when used with oxygen is probably the best and safest of the common anæsthetics for this type of patient. On account of the general depression slightly more oxygen can be given than with normal cases without any loss of efficiency, but should extra relaxation be required it is better to use a combination of gas and oxygen with a lipoid soluble anæsthetic, or in conjunction with regional analgesia by nerve block. Heat loss can be reduced by the use of rebreathing apparatus, and the patient will benefit from the slight CO_2 content. It is of importance that there should be no resistance in this circuit due to sticking valves, or too tightly packed soda lime.

Ether is probably the most popular anæsthetic. It is easy to use, is safe, and satisfies most of the requirements of an anæsthetic. When given by the open method there is some considerable heat loss due to the vaporisation on the mask; this may be reduced by building up towels into a semi-open cone which produces a small amount of rebreathing. When used in conjunction with gas and oxygen in a closed circuit apparatus this loss is cut to a minimum.

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Advantages of ether are:

(*a*) Acts as a stimulant.

(*b*) May be used in high oxygen concentration.

(*c*) High safety factor.

Divinyl ether is more expensive than di-ethyl, but has some advantages over it provided that the necessary apparatus is at hand. Vinesthene given in conjunction with gas and oxygen is not unpleasant, is rapid acting, and gives a very complete relaxation. There is slight respiratory depression but this can be compensated for in a closed apparatus. Using such apparatus it is sufficient to give about ten drops per minute, decreasing the quantity as time goes on; strangely enough, increasing the rate of flow does not make anything like a proportional increase in the depth of anæsthesia.

Cyclopropane has three very great advantages. Very high oxygen percentages may be used (75 to 90 per cent), there is a slight increase in blood-pressure, and there is little toxicity or lung irritation. It is a rare gas, and requires complicated apparatus; therefore, its general use is limited.

Chloroform, owing to its high toxicity, is unsuitable in shocked patients, except in the hands of a very few skilled in its use.

Post-operative treatment. These patients have been operated on at a time of lowered resistance and require every precaution to prevent pulmonary complications. In abdominal cases pain may limit the respiratory movements; these patients appear to be more comfortable if the wound is dressed with a firm binder than if it is merely covered with a dressing held in position by a strip of surgical plaster.

Routine breathing exercises with CO_2 and oxygen help to keep the lungs expanded. They should be of short duration (two minutes), and should be given four-hourly for, at any rate, three days after operation.

Casualty cases may not have been in good health before their injuries. Intercurrent disease, such as pulmonary tuberculosis, diabetes, chronic renal disease, should be

detected before operation if possible, but if that is not so, should be detected by routine examination in the early post-operative period, so that suitable treatment may be instituted.

Conclusions

That no patient in the condition of surgical shock should be given an anæsthetic unless immediate operation is absolutely essential.

That the correct anti-shock treatment should be given before such operation, and that the anæsthetist should be fully conversant with the measures taken.

That intravenous barbiturates must be regarded with some suspicion, and given the greatest care.

Gas and oxygen by means of a closed circuit apparatus is the most satisfactory anæsthetic, and that ether and divinyl ether should be used to give extra relaxation when required.

That oxygen lack greatly increases the degree of shock, and that therefore the airway must be kept unobstructed, the oxygen content of the required mixture kept high, and the resistance of the circuit kept low.

CASUALTY ANÆSTHESIA IN THE E.M.S.

BY

F. BARNETT MALLINSON

Honorary Anæsthetist, Princess Beatrice, Royal Waterloo, Woolwich Memorial Hospitals, and St. John's Hospital, Lewisham; Assistant Honorary Anæsthetist, National Dental Hospital; Anæsthetist, E.M.S.

DURING the 1914–18 war the surgery of casualties and their post-operative progress was undoubtedly hampered by the relatively crude and undeveloped state of the science of anæsthesia. A study of the literature shows that for the first years at least, reliance had to be placed almost entirely upon chloroform and ether. It has been stated that the mortality from primary amputation through the upper third of the thigh under chloroform and ether was over 90 per cent.[1]

Since the discovery of nitrous oxide anæsthesia by Wells in 1842; of ether anæsthesia by Morton in 1846 (actually first used by Crawford Long also in 1842, but not made public); and the subsequent application of chloroform to anæsthesia by Sir James Simpson in 1847; practically no advance had been made. In point of fact, nearly all the important progress in the subject has been the fruit of the last twelve years.

In this war, however, owing to the development of intravenous anæsthesia and the modern gases and machines, there lies with the anæsthetist of the present day, the power vastly to improve the surgeon's chances of success, and decrease his inevitable mortality by the use of safer and less toxic anæsthetic agents than were available 25 years ago.

The Drugs and Methods at our Disposal

These fall into four groups:

(1) *Intravenous barbiturates.* Pentothal, nembutal, and evipan.

(2) *Gases.* Those of chief importance being nitrous oxide and cyclopropane.

(3) *Volatile liquids.* Chloroform, ether and ethyl chloride. Also vinyl ether.

(4) *Spinal analgesia.* Which owing to its prodigious advance over all previous drugs, is mainly represented by percaine.

Six months' experience in several hospitals and under widely differing conditions, of military and civilian casualty anæsthetics personally administered, added to observation of many others, has led one drastically to reduce this field, at least as far as the more seriously wounded or ill cases are concerned. It is in these that the choice of the least damaging and toxic anæsthetic often spells the difference between life and death, in contrast to the lightly wounded in which the choice, generally speaking, relates rather to comfort than to actual risk—chloroform excepted.

Choice of Agents

A careful consideration of the condition of the serious cases is first essential. Experience to date suggests that they are mainly divisible, from the anæsthetist's point of view, into three groups:

(1) *Immediate cases.* These resemble road accidents in many ways, but unlike them a strong factor of psychic shock may pre-exist, particularly with bombed civilians. Shock and hæmorrhage are, of course, outstanding features.

(2) *Recent (transferred) cases.* Many of these are relatively clean, particularly the civilian cases, but others have been very toxic and ill with gas gangrene and other infections, such as many of the cases evacuated from Dunkirk.

(3) *Re-operation cases.* These are recovering as a rule, and are relatively fit. They do not concern us.

It can be stated at the outset that, in the author's opinion, there is no place in this work for such a toxic and damaging drug as chloroform. Ether is less severe in its effects on the organism, but in view of its known deleterious actions on the organs and tissues of the body which include: (*a*) reduction in oxygen-carrying capacity of the blood; (*b*) some degree of hæmoglobin destruction; (*c*) increase in coagulation time; (*d*) considerable lowering of alkali reserve; (*e*) cardiac dilatation with consequent drop in blood-pressure after a time, and further, in the light of recent observation, it is not considered justifiable to employ it if less toxic agents are available from which equally satisfactory anæsthesia, from the surgeon's point of view, is obtainable. This view is supported by the experience of the last war.[2] The only claim that can be raised in favour of chloroform and ether is that of their portability. What, however, could be more portable than a syringe and needles and a few ampoules of pentothal or evipan, which will cover any situation where the question of portability is paramount, and which are also non-inflammable?

Experience of spinal analgesia in the last war made clear how deadly it can be in shocked and hæmorrhagic cases.[2, 3]

This leaves us with the gases, nitrous oxide and cyclopropane, and the barbiturates, evipan and pentothal.

Nitrous oxide is entirely without toxic effects on the body. When serious sequelæ arise after its administration they are due to anoxæmia, as has been so convincingly shown by Courville.[4]

Cyclopropane is almost as non-toxic[5, 6, 7] provided care is taken to avoid overdosage, shown by abnormal cardiac action, which if ignored can, though rarely, produce dangerous results.[8]

So much has been written about the quick-acting intravenous barbiturates that no advantage is to be gained from further discussion of them except to stress the opinion (which seems to be confirmed by an increasing number of the author's anæsthetist acquaintances) that shock is *not* a contra-indication; properly administered, in fact, the reverse is outstandingly clear.

Pre-medication

Before discussing actual techniques, a word about the question of pre-medication is needed. A careful enquiry should be made as to how much or how recently morphine has been administered to wounded persons, and a careful estimation made of the degree of shock and hæmorrhage present. Many patients need nothing. Omnopon gr. 1/3 to gr. 2/3 and scopolamine gr. 1/150 will usually suffice for the others.

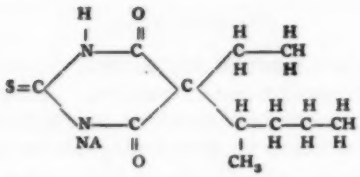
Techniques

Technique of administration varies according to the conditions. In this sense the patients can be roughly divided into extra-abdominal and abdominal cases. The former can again be subdivided into reasonably fit, toxic, shocked and hæmorrhagic.

(1) *Reasonably fit patients.* Pentothal 0.3 to 0.5 grm. (6 to 10 c.c. of the usual 5 per cent solution) followed by nitrous-oxide-oxygen is almost invariably adequate for all extra-abdominal procedures. Very rarely a few 100 c.c. of cyclopropane "supplement" may be needed (instead of ether) or perhaps a further small dose of pentothal. Such occasions, however, as this is needed, tend to diminish with practice. Carbon-dioxide absorption, however, is always an advantage in any case.

(2) *Toxic cases.* The same remarks apply to this group. Here, to avoid ether will be generally conceded to be most important. A small induction dose of pentothal (up to 0.5 grm.) is far less likely to cause liver and other tissue damage than ether.

In connexion with toxic patients it has been made abundantly clear by work on the recent influx of military casualties, many of whom had or were desired to have "M and B," that the administration of pentothal (which contains 12 per cent sulphur) presents no contra-indication even where the "M and B" is given intravenously during operation. One took the decision to administer pentothal to such cases on the following reasoning:



A study of the formula of pentothal suggests that the sulphur is in firm combination. The pentothal is injected directly into the bloodstream, and after undergoing chemical reaction in the liver is said to be excreted by the kidneys in combination with urea. It would therefore seem that the sulphur is never in a position to undergo that particular reaction which results in the formation of sulphhæmoglobin. This contrasts with what is known about sulphur ingested by mouth. Here the sulphur whilst in the gut forms sulphuretted hydrogen, which is widely considered to be the dangerous substance where sulphanilamides and their related compounds are concerned. This reasoning may be wrong, but the results were entirely up to expectation, not the slightest ill effects as a result of the combination of the two drugs being observed. I understand that the makers of pentothal are working on the subject and that the results may soon clear up this point.

(3) *Shocked cases.* Pentothal in divided doses, repeated as needed, as sole anæsthetic has been found excellent for these patients, and frees the anæsthetist from the incubus of controlling a machine so that he can devote more attention to the transfusion which will almost certainly fall to his care; in fact the two procedures, that of anæsthetic and transfusion, may be advantageously combined by administering the pentothal through the transfusion delivery tube or by the method of combined continuous infusion of saline and pentothal demonstrated by Carnac-Rivett and Quayle,[9] substituting blood for saline where necessary.

Nitrous oxide may be better omitted from severely shocked cases for the reason put forward with reference to the next group.

(4) *Hæmorrhagic cases.* In patients who are exsanguinated and shocked two forms of tissue anoxia may

be present: anæmic anoxia and stagnant anoxia. To administer an anæsthetic so weak as regards its potency that it is often only effective in the presence of a considerably restricted oxygen intake does not seem to be a sound method in dealing with such patients. Pentothal, however, is a potent anæsthetic and excellently tolerated by these patients if their oxygen-carrying handicap is overcome by oxygen and carbon-dioxide administration. This can be effectively given in the form of oxygen plus rebreathing from the gas machine. A little of the anæsthetic, it should be noted, goes a long way in these cases as is illustrated:

Illustrative case 1. H. T. S., male, aged 32. Exploration of wound for severe secondary hæmorrhage. Very pale and bloodless. No pre-medication given. Induction with 0.15 grm. (3 c.c.) of pentothal. This gave adequate anæsthesia for 15 minutes. Two further doses of 0.15 grm. and 0.1 grm. respectively, allowed of the comfortable completion of the operation which occupied altogether 45 minutes.

(5) *Abdominal cases.* Adequate relaxation can be obtained with a pentothal induction followed by cyclopropane. This combination can well be said to have saved many desperate cases.

Illustrative case 2. G. N., male, aged 30. History of perforating gunshot wound of the abdomen 36 hours previously. Acute peritonitis. Subnormal temperature. Feeble rapid pulse. Comatose and apparently moribund. Taken direct from stretcher to table for immediate laparotomy. Anæsthetic, cyclopropane. Four intestinal perforations found and sutured. Peritonitis drained. Patient survived operation, but only improved up to a point. Thirty-nine days later re-operated for pelvic abscess. Still a very sick man. Same anæsthetic. After this, improvement was steady and final recovery complete.

These techniques apply not only to general surgery, but can be modified to suit many special techniques. The principle, however, remains the same. Space forbids a full description but the example of brain and skull wounds will illustrate the point. In these patients success was attained by first cocainizing the larynx and then inducing

anæsthesia with a small dose of pentothal or evipan. An intratracheal tube, well smeared with percaine ointment, was then passed, the throat packed off and anæsthesia maintained with nitrous-oxide-oxygen supplemented if necessary with small occasional additions of cyclopropane. The latter, in the few cases in which it was needed, amounted only to 50 to 100 c.c. per minute (insufficient to have any effect on hæmorrhage) and was stopped ten minutes beforehand if it was intended to use diathermy.

The difference in post-operative condition between the etherized and the non-etherized patients has been amazing, and as a matter of clinical experience is far more impressive than any statistics. This difference has been repeatedly commented on by ward sisters and medical officers who are observing the patients closely all the time. The author has also received personal communications from several observers[10, 11, 12] who have adopted the same principle of avoidance of chloroform and ether, which unreservedly confirm this fact.

Statistics are not easy to get together under wartime conditions (this fact is manifest from a study of the literature dealing with the last war), but below are shown the results in 200 consecutive and unselected military casualties, anæsthetized by various anæsthetists, from amongst those dealt with at the time of Dunkirk. A large proportion of these men had gas gangrene and all were severely exhausted. They are divided simply into two classes, according to whether they were moderately or severely ill.

While it is not suggested that deaths were necessarily anæsthetic deaths, the point is stressed that in patients dying in the early post-operative period, the anæsthetic substances employed must be considered to have played a vital part in the result, and may well have just tipped the scale. For this reason deaths within seven days of operation have been considered as germane to the point at issue.

STATISTICAL TABLE

"Moderate" = 154 cases.

Non-Ether Cases

	No. of cases	Survived 7 days	Died 7 days	Mortality %
Barbiturate + N_2O—O_2 ...	80	80	0	0
N_2O—O_2	3	3	0	0
Cyclopropane	1	1	0	0
Total	84	84	0	0
Ether Cases				
Barbiturate + N_2O—O_2—E ...	51	51	0	0
N_2O—O_2—E	19	19	0	0
Total	70	70	0	0

"Severe" = 46 cases.

	No. of cases	Survived 7 days	Died 7 days	Mortality %
Non-Ether Cases				
Barbiturate + N_2O—O_2 ...	31	31	0	0
N_2O—O_2	—	—	—	—
Cyclopropane	4	4	0	0
Total	35	35	0	0
Ether Cases				
Barbiturate + N_2O—O_2—E ...	4	3	1	25
N_2O—O_2—E	7	6	1	14
Total	11	9	2	18

Details of deaths

(1) W. L., male; aged 20 years. Severe gas gangrene whole of left arm. Very ill and severely toxic. Amputation through the shoulder. Continuous transfusion. Died seven hours after operation without regaining consciousness. Evipan induction followed by nitrous-oxide-oxygen-ether.

(2) W. F., male; aged 26 years. Compound fracture humerus, gunshot wound. Developed pneumonia, died seventh day. Gas-oxygen-ether.

Two further illustrative cases are given here by way of contrast. (Note: these illustrative cases are taken from the above statistics.)

Illustrative case 3. A. B., male; aged 39 years. Very severe gas gangrene of thigh and extending right up into buttock. Very toxic. High temperature. Pentothal and nitrous-oxide-oxygen. No trouble during operation. Steady progress to complete recovery.

Illustrative case 4. N. M., female; aged 24. Rescued from debris of big building. Very severe shock and hæmorrhage. Arm pulped; exsanguinated. Resuscitated for four hours before possible to take to theatre. Starting fourth pint of blood at commencement of operation. Small repeated doses of pentothal through transfusion tube. Total amount of pentothal 0.85 grm. Operation time about 40 minutes. Condition satisfactory all through and after.

Conclusions

(1) Nitrous-oxide-oxygen anæsthesia, preceded by a small induction dose of pentothal (0.3 to 0.5 grm.), gives all the relaxation and quiet the surgeon needs for extra-abdominal work. Ether is superfluous.

(2) Cyclopropane, combined with a barbiturate induction, is efficient for abdominal work.

(3) These anæsthetic agents (which can be adapted to almost any special type of work) are the least damaging and toxic at our command.

(4) The difference between non-toxic and toxic anæsthetic agents administered to patients already severely damaged frequently means the difference, quite literally, between life and death, in the early post-operative period.

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THE NURSE-ANÆSTHETIST CONTROVERSY

A CONSIDERABLE correspondence raged recently in the columns of the *Lancet* and *British Medical Journal* over the subject of nurse-anæsthetists. The ball was set rolling by the printing in each of these journals of a letter sent to them from the Association of Anæsthetists of Great Britain and Ireland with a request for its publication. This letter was a copy of that sent from the Association to the authorities of Addenbrooke's Hospital, Cambridge, who had inserted an advertisement in the *Nursing Times* asking nurses to apply to the hospital for the opportunity of undergoing six months' training to fit them to act as anæsthetists to the hospital. The officers of the Association pointed out why, in their opinion, this was a regrettable step to be taken by any hospital of standing, and that there was nothing to show that Addenbrooke's had tried to get medical men or women to fill the anæsthetic posts which required filling. Before relating the chief points in the letters which subsequently appeared, we may, perhaps, be allowed to make a few general observations on the question of nurse-anæsthetists.

The matter may be looked at in two ways: firstly, there is the purely practical aspect of the question; and secondly there is the question of how encouraging nurse-anæsthetists affects the progress of anæsthesia and, therefore, indirectly the welfare of all patients who undergo operations. So far as the purely practical aspect of the matter goes the first point is that of course an intelligent nurse can be trained to give anæsthetics very well, provided that the methods and agents employed are strictly limited. The administration of an anæsthetic so that the patient is amenable to all the surgeon's requirements is not however the beginning and end of what should be provided by the anæsthetist. In addition he must be relied on to estimate the general condition of the patient throughout the operation, and warn the surgeon when there is anything unsatis-

factory, or when there is need for hurry. If he is not competent to do this the surgeon is under an extra, a hampering, and a quite unnecessary strain, that of being constantly on the look out for any untoward effect of his operative manœuvres or of the anæsthetic. This extra duty is inevitably imposed on the surgeon when his anæsthetist is an unqualified person, for the surgeon's will be the sole responsibility for any catastrophe. Not only is the nurse, from her lack of training, unable to appreciate early enough commencing troubles, but also to estimate the likelihood of their coming from what she knows of the effects of the operation, and of her own administration. Moreover it must be difficult for her to take in hand authoritatively remedial measures when these are suddenly and urgently required; yet this is just one of the aids on which the surgeon should most surely be able to count from his anæsthetist. We need not further point out that it is in the patient's best interest that the anæsthetist should have a say in the selection of the anæsthetic, having seen the patient beforehand, and also in the immediate treatment after operation so far as this is influenced by the anæsthetic that has been taken or its effects. How can anyone who is not medically qualified be expected to take a proper part in these functions? The question of legal responsibility is involved here, and we would do well to remember the judicial finding in the case which put an end to nurse-anæsthetists in Canada. Without quoting the exact terms we can say that the court pointed out that since whenever a patient was submitted to an anæsthetic a certain amount of risk was run, the surgeon was open to grave criticism if he did not reduce this risk to a minimum by putting the anæsthetic in charge of a person as highly qualified for the post as he could obtain. Exactly the same judgment might surely be passed supposing that there were a fatality in the hands of a nurse-anæsthetist at a big hospital in this country. It is certain that if, as one of the correspondents points out, Addenbrooke's offered proper returns, the hospital could have a specialist anæsthetist as soon as it asked for one.

Probably, if the ultimate truth were known, financial

difficulty is at the bottom of the situation which has arisen. What is wanted is that the lay governing body of Addenbrooke's, and of any other hospital similarly situated, should understand that they are failing in their duty if they allow financial considerations to put their patients' lives in peril. Let them reduce the number of their beds if necessary. Better to have fewer patients thoroughly safeguarded than a larger number, some of whom are exposed to unjustifiable risk. If it is necessary to have more money in order to secure safe anæsthesia, then more money must be got, if needs be in the manner suggested above.

The above remarks apply in ordinary times. Addenbrooke's have been presented by the war with a particular difficulty in regard to anæsthetists, and here is the real excuse for the step taken, as pointed out in a letter sent from the secretary of the Hospital's Medical Committee. Several of the visiting anæsthetists left for work in the Services. Newly appointed resident anæsthetists are often not sufficiently experienced, and the hospital preferred to arrange for a supply of its own trained nurse-anæsthetists. Certainly a competent nurse-anæsthetist is preferable to the inexperienced medical man, but we believe the hospital would have had no difficulty in finding men and women of due experience and competence had it been willing to offer a proper return for their services.

One fact brought out by the correspondence is the inefficient training of the medical student in anæsthetics. To this is attributed the incompetence often shown by recently appointed resident anæsthetists, the incompetence which Addenbrooke's wishes to replace by the competence of a trained nurse-anæsthetist. This deficiency in anaesthetic education is nowhere more fully recognised than in the ranks of the teachers of anæsthetics. One of these at Oxford, for example, complains that in a three-years clinical course the student is attached to the department of anæsthetics for one week and receives four lectures. Yet Oxford is, at the moment, the one place in Great Britain where the science of anæsthesia can be studied with sufficient facility and support. Reverting to the position of nurses in this matter we believe that suitable courses of

training should be available for nurses who may be required to give anæsthetics under medical supervision in an emergency. Such courses, we say, would in no way qualify nurses as anæsthetists; even the choice of anæsthetic would be determined by the medical man in charge. With these sensible and practical recommendations from the ruling body of nurses we may well close our observations. It is plain that advantage will accrue by having nurses trained to act as assistants to the anæsthetist, or to act as his substitute under supervision; but only disadvantage and dissatisfaction would accompany the creation of a class of nurse-anæsthetist. Nor need we point out that the nurse-anæsthetist could not be expected to, and certainly would not, contribute towards the advancement of the science of anæsthesia. For that purpose it is essential that the practice of anæsthetics remains in the hands of those who are, by their general training, likely to accelerate the progress of their specialty.

ENDOBRONCHIAL LIPIODOL UNDER GENERAL ANÆSTHESIA IN CHILDREN

BY

A. H. L. BAKER, L.M.S.S.A., D.A.

Anæsthetist, West Middlesex County Hospital, Isleworth.

IN giving lipiodol to children, three methods are available.

1. Intra-laryngeal, through crico-thyroid membrane.
2. Pharyngeal and through the glottis.
3. By means of intubation of the larynx.

Methods 1 and 2 are used in adults with a conscious patient and the use of cocaine. Both these procedures are to be condemned in children, because consciousness is bad for psychological reasons, and cocaine for its toxicity. Anyone acquainted with Chevalier Jackson's work and opinions can have no doubt about the inadvisability of using cocaine in children.

This brings us to the third method. Having tried several ways of doing this, the one about to be described appears to be the best, and it fulfils the conditions here laid down. In addition it is, in practice, possible to repeat it many times without harm to the child, and the advantages of using general anæsthesia, preceded by adequate basal narcosis, are very definite.

1. The patient need not even know that anything unusual is going to be done to him, so that psychological upset does not occur. Indeed, the more often it is done on the same patient the easier it becomes.

2. The onus of co-operation is shifted from the patient to the anæsthetist.

3. Respiration and coughing are largely controllable

with the patient intubated, and the CO_2 absorption technique in use.

4. It makes the whole procedure, step by step, easier to regulate.

5. In practice the X-ray results are excellent.

Anæsthesia

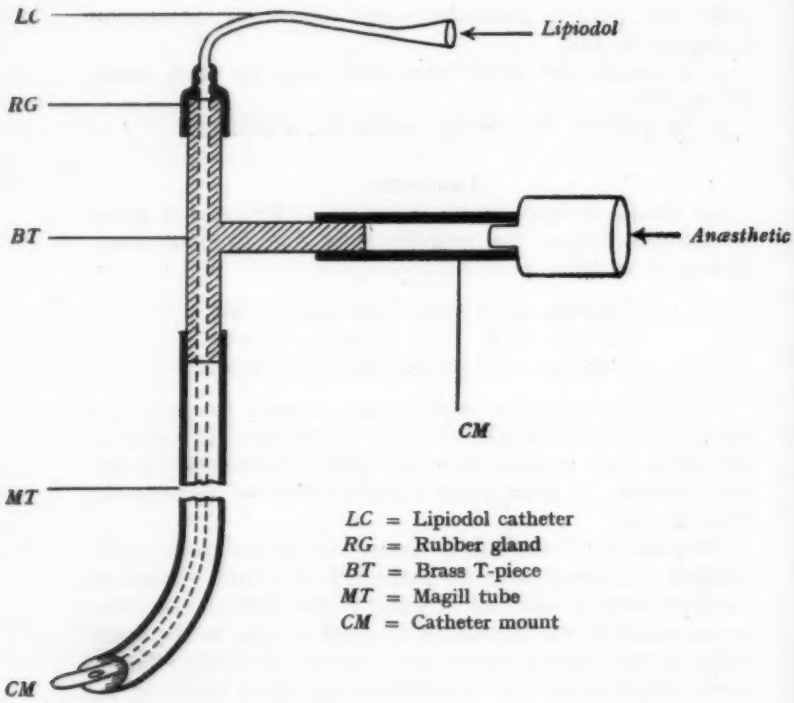
(*a*) *Basal.* A hypodermic injection of hyoscine is given 45 minutes before the anæsthetic is due to commence. Dosage is as follows:

Children aged 2–4 years gr. 1/600.
Children aged 4–12 years gr. 1/450.
Children aged 12–16 years gr. 1/300.

Twenty-five minutes later, rectal avertin (0.1 c.c. per kilogram of body weight) is given in 2½ per cent solution. Although, for general reasons, some anæsthetists prefer paraldehyde, in these cases avertin seems to give quieter respirations.

(*b*) *General.* Induction is carried out with nitrous oxide, oxygen and ether, with the assistance of a little vinesthene or chloroform if desired. Owing to the difficulty so often experienced in the intubation of children due to the sensitivity of the child's larynx and trachea to foreign bodies even under quite deep anæsthesia, the third plane of the third stage should be reached before intubation is attempted. The tube is passed orally by direct vision laryngoscopy, as the nasal route is so liable to be complicated by the presence of adenoids and consequent hæmorrhage. The more smoothly all this is done the better for the final X-ray results. Subsequently light second plane maintenance has proved adequate to keep the laryngeal reflexes sufficiently damped down. CO_2 absorption helps to diminish respiratory excursions.

Lipiodol is introduced either through a fine, soft rubber (size 2 or 3) or gum elastic (size 1 or 2) catheter, which is inserted inside the Magill tube so that its narrow end projects about a quarter-inch beyond the bevelled end of the latter. In this way no lipiodol can get into the endotracheal tube itself and so interfere with respiration. Actual



The T-shaped tube was made up for me in brass by the hospital engineer, but there are standard T-pieces, such as Dr. Magill's for endobronchial work, which would serve equally well. A rubber gland, as used on cystoscopes to prevent water leakage during the passage of ureteric catheters, fits over one end of the cross-piece to make a gas-tight joint with the lipiodol catheter; the gland aperture needs slight enlargement before insertion of the catheter. The other end of the cross-piece fits into the Magill tube. The remaining limb of the T-tube connects up via a catheter mount to the anæsthetic apparatus.

If percaine ointment, one per cent, is used to lubricate the endotracheal tube, it assists in desensitizing the vocal cords.

The syringe used to inject the lipiodol is a slight modification of Dr. Fenton's model as made by Messrs. Down Bros. It has a special conical nozzle which readily fits any small size catheter of the types suggested.

bronchial intubation seems an unnecessary refinement; if the catheters' ends lie about half an inch above the bifurcation of the trachea, and suitable posturing of the patient is carried out, lipiodol can be dropped into either bronchus at will. The suitable sizes of Magill tube are numbers 3 to 6 according to the size of the patient, and the length required to reach the bifurcation varies in the same way (6 to 9 inches) but can be worked out individually if required. Perhaps the surest way is to check the position under the X-ray screen after the injection of 1 to 2 c.c. of lipiodol.

Apparatus required

Any gas-oxygen-ether machine having a CO_2 absorption circuit, and if possible a vinesthene drip attachment. This last is a refinement, but a very helpful one.

Procedure in a Typical Case

Preparation.

An expectorant mixture containing a good dose of Tinct. Ipecac. is given for at least four days before to clear out as much bronchiectatic secretions as possible.

Atropine gr. 1/200 to gr. 1/100 is given the night before. Ordinary mucus needs to be dried up but not so much as to leave inspissated bronchial plugs which only lead to false appearances in the X-ray pictures.

The child is removed to the X-ray department as soon as the avertin has taken effect. Then anæsthesia is induced with nitrous oxide, oxygen, vinesthene and ether as previously discussed. When the endotracheal tube has been passed the throat is packed off with saline gauze. It is best to fit up the apparatus ready as in the diagram before intubation, leaving only the catheter mount to be attached. The lipiodol (10 to 20 c.c.) is perforce injected slowly through a small catheter, thereby preventing a quantity sufficient to cause respiratory obstruction from being shot into the bronchi all at once. During this time the posture of the patient must be changed repeatedly to allow the lipiodol to spread throughout the bronchial tree,

the child being alternately rotated for 1 to 2 minutes each, into both lateral and the prone positions before screening.

It is seldom necessary to fill the upper lobes in a child, and the procedure described serves adequately to fill the middle and lower zones both anteriorly and posteriorly if the child be kept with the head slightly raised throughout. If the upper zones are to be filled, the head end of the body must be lowered for a few minutes particularly when filling the left side. An X-ray table, capable of revolution about both horizontal axes, is a great help.

After withdrawal of the syringe a spigot may be inserted to close the end of the lipiodol catheter.

It is obvious that coughing, straining and violent respirations will prevent proper distribution of the lipiodol, and must be prevented. Quiet breathing will enable the radiologist to time the exposures more easily, and so minimize blurring of the pictures. Excessive mucus in the bronchi prevents even spread of the lipiodol.

None of the children has had any aggravation of their bronchial symptoms from this method of anæsthesia, or been in any way the worse for the operation.

Summary

A method for giving lipiodol to children under endotracheal anæsthesia is described, and a diagram of the apparatus used is shown.

The writer wishes to acknowledge the great help and encouragement obtained from Dr. T. Nelson, Senior Physician to the hospital, in the preparation of this article. But for his requirements in the detection and localization of early bronchiectasis in children, this interesting work would not have been undertaken. Thanks are also due to Dr. J. B. Cook, Medical Superintendent of the hospital, for permission to publish.

THE DIPLOMA IN ANÆSTHETICS

As a result of the examination held in May last, the D.A. has been granted to the following:

J. B. Bamford, Katharine Banks, J. F. J. Bereen, D. J. A. Brown, K. C. Brown, Samuel Cardew, P. C. Conran, J. R. Dunn, R. U. Gordon, K. C. Grigor, F. R. Gusterson, W. E. Hadden, S. R. T. Headley, Elliott Isaacson, Mary K. W. Langston, J. D. Laycock, J. A. Lee, Samuel Mark, P. J. W. Mills, W. W. Mushin, E. A. Pask, L. M. Shorvon, M. R. W. Spacek, W. N. Taylor, R. B. Thornton, Joan Watts, and H. D. Wyse.

Mr. A. S. Daly and Dr. Langton-Hewer have been appointed examiners.

Following the November examination the Diploma has been granted to:

D. Aserman, W. Auld, A. J. W. Blard, H. M. Bird, Agnes C. Clark, R. M. Davies, F. C. Deller, O. P. Dinnick, Nancie I. Faux, W. J. Finnie, H. F. Harvey, D. Hewspear, T. H. Hughes, J. V. Human, H. Kopelman, J. L. Linacre, R. E. P. McCullough, H. C. Maclaren, T. T. P. Murphy, N. C. Porter, J. F. Rickards, T. D. Rochford, H. T. Shervon, Margaret N. Smith, T. H. Taylor, A. Tindal, W. J. Walker, and H. B. Wilson.

ABSTRACTS

"High Spinal Anæsthesia." H. J. FRASER, in *Canadian Medical Association Journal,* September 1940, p. 251.

TOTAL spinal anæsthesia can be produced, the author points out:

(1) By increasing the dosage of the drug. Doses of 300 mg. novocaine often produce total anæsthesia.

(2) By increasing the volume of the solution injected, thus 15 c.c. of 1 per cent novocaine will produce total anæsthesia.

(3) By injecting the drug at a high level.

(4) By spinal decompression and barbotage.

(5) By forcible injection.

Fraser goes on to describe methods he considers safe for operations on the upper abdomen. The first is by withdrawing 4 c.c. of spinal fluid, dissolving in it 150 to 200 mg. crystals of novocaine, and re-injecting. The patient sits, or lies on the side. Later he is placed in 10 degrees Trendelenburg position. The second technique is volumetric control attained by barbotage. The third is Howard Jones' with 1 to 1500 percaine solution.

The author believes the day is not far distant when the patient will be operated on in full consciousness under total spinal anæsthesia, pain only being blocked off.

"An Anæsthetist at a General War Hospital." REX BINNING, in *British Medical Journal,* December 7, 1940, p. 794.

THE hospital was a tented one, with consequent difficulties of lighting and heating which were overcome by methods described by the author. As regards anæsthetic technique,

routine premedication was omnopon gr. 1/3, and scopolamine gr. 1/150, one to one and a half hours before operation, this was found to give much more sedation than morphine gr. 1/4 or atropine gr. 1/150.

When a rapid effect was desired the omnopon and scopolamine were given intravenously. The subsequent anæsthetic mostly used was pentothal 0.5 grm. followed by nitrous oxide and oxygen. It was noticeable how high a percentage of oxygen was used with benefit on patients who were both tired and badly wounded. The author believes that widespread use of intravenous anæsthesia will show an unfavourable mortality rate compared with that following nitrous oxide or cyclopropane. Patients for tonsillectomy had nose and throat cocainized and a dental prop inserted before induction of anæsthesia by pentothal. Spinal analgesia was obtained either by 1:1500 percaine or else 5 gr. stovaine which later was mostly used for haemorrhoids cystoscopies and the like. The author concludes that "medium surgery" is possible in a tented hospital without any sacrifice of professional standards.

"A Simplified by-pass Control for CO_2 Absorption." J. P. Franle and J. A. W. Robinson, in *B.M.J.*, November 30, 1940, p. 746.

The features of the control for facilitating the technique of CO_2 absorption are: (1) Simplicity in operation. (2) Reduction of dead space to a minimum. (3) Low internal resistance. (4) Rapid and complete isolation of the Waters canister when desired. (5) Contents of the bag remain undisturbed when the patient breathes air. (6) The bag may be filled with any mixture before application to the patient. (7) Precision adjustment, which may be determined by the operator's sense of touch, is rendered easy when visual adjustment is either difficult or impossible. (8) Ease in dismantling for cleaning and greasing—though the drum cannot blow out with gas pressure. (9) Connexions for bag and canister are interchangeable, for use on either left or right of the patient's head. (10) One

oxygen inlet only required to supply the patient, irrespective of the position of control. (11) The canister may be recharged during operation without losing the contents of the bag.

The control, which consists of a small metal cylinder containing a rotating drum, is attached direct to a facepiece. There are four outlets from the cylinder—one providing direct access to air, whilst the other three open into branch pipes as follows: (*a*) to a rebreathing bag; and (*b*) and (*c*) to the front and rear ends respectively of the Waters canister.

The internal rotating drum—the function of which is to cut out and into circuit as desired the three cylinder outlets referred to above—is closed at the top with a milled flange to facilitate rotation and is provided with an expiratory valve.

"*Anæsthesia in Chest Injuries.*" J. HALTON, in *Lancet*, November 30, 1940, p. 675.

THE author starts with a consideration of the main types of chest injury encountered in war service and then of the physiological changes resulting. Wound shock interrupts the cycle of cell respiration and oxidation, through action on reduced cytochrome, and morphine and anæsthetic drugs acting on another respiratory enzyme, dehydrogenase, further retard the vital cycle and promote oxygen starvation of the tissues. The mechanism of respiration with one, say the left, pleural cavity open is that the left lung collapses and the mediastinum becomes more mobile. Air is sucked into the left pleural cavity through the opening in the chest wall and the mediastinum moves over to the right and prevents full expansion of the active right lung. With expiration the mediastinum moves to the opposite side, air is expelled through the pleural wound and the active lung is prevented from emptying its expired air completely. In addition some of the expired air containing a raised percentage of carbon dioxide passes into the bronchi of the collapsed left lung. From here it is inspired again into the active lung. As a result the active

lung is never fully expanded and the carbon-dioxide content of the air which it does receive is much higher than it should be. Thus the patient is made to breathe more and more deeply. The muscular effort still further raises the CO_2 tension in the blood.

The form of anæsthesia used must combat the existing anoxia and relieve the patient of the necessity for increased respiratory effort until the pleural cavity can be closed. Every effort must be made that an adequate supply of oxygen is brought to the tissues after operation. Neither closed circuit gaseous anæsthesia nor the high spinal method suits these patients. Intratracheal insufflation is the method of choice. The volume of anæsthetic vapour blown into the lungs must be between 15 and 25 litres a minute and produce a pressure in the lungs of 5–8 mm. of mercury. If both sides of the chest are open more may be needed, but pulmonary pressure should not exceed 12 mm. mercury. The diameter of the catheter must not exceed half that of the trachea in which it is placed. Nitrous oxide and cyclopropane are ruled out of this method by their cost, but the necessary volume of ether or chloroform can be rapidly built up in the bloodstream and as rapidly eliminated, thanks to the hyperventilator. Thus the body cells are protected from too prolonged and toxic application of the drugs. Ether can generally be used unless diathermy has to be employed. Only simple apparatus is requisite. Generally the patients are not fit for morphine or barbiturates before operation, and a rapid induction with ethylchloride or vinesthene is carried out. Then through the nose a Magill's catheter of suitable size is introduced as expertly as possible. If this cannot be achieved tracheotomy must be performed and anæsthesia maintained through the tracheal opening.

"*Local Anæsthesia in General Surgery.*" RUTH MANSFIELD, in *B.M.J.*, October 26, 1940, p. 573.

THE author gives the results in a series of 172 thoracoplasties over a period of three and a half years. Four types

of anæsthetic were used, nitrous oxide and oxygen with a trace of chloroform, cyclopropane with pentothal induction, spinal, and local. A table is given showing the effects on pulse-rate and on blood-pressure of the various methods. The author's conclusion is that local anæsthesia has advantage over other methods for this type of operation.

In the *Lancet* for November 23, 1940, p. 664, Clarke and Kersal draw attention to the value of local and regional anæsthesia for shocked patients. They cite the experience of teams of surgeons working during the Finnish campaign when comparison between general and local anæsthesia proved much in favour of the latter.

REVIEWS

"Ross and Fairlie's Handbook of Anæsthetics." Revised by R. J. MINNITT. pp. 364. Price 12*s*. 6*d*. E. & S. Livingstone.

MOST of our readers will be familiar with "Ross and Fairlie" which has been one of the most successful small text-books on anæsthetics. Its value is now enhanced by the chapters which Minnitt has added. These deal with cyclopropane closed circuit absorption methods and use of oxygen, carbon dioxide, and helium in therapeutics. Minnitt has also, as must be expected, amplified the pages on anæsthetics in midwifery and has devoted fresh space to information about vinesthene. All the best features of the earlier editions are retained, and the book will continue to hold its place as a first-rate guide to the student who is learning as well as to the practitioner who occasionally administers anæsthetics. Naturally, in a comparatively small book there are faults of omission, and these in our opinion are mostly noticeable in the pages devoted to spinal anæsthesia. The work is admirably printed and illustrated.

"Essentials of General Anæsthesia, with Special Reference to Dentistry." R. R. MACINTOSH and FREDA PRATT. pp. 334, illustrations 226. Price 25*s*. Blackwell Scientific Publications, Oxford; 1940.

THIS is a very good book which ought to be still better. The fault lies in its scope. It does not deal in enough detail with anæsthetics not concerned with dentistry. In

everything to do with anæsthesia for dental work the book is full, explicit and a perfect guide for the student. It is a great pity that the authors have not given the same detailed attention to anæsthesia for general and other specialised surgery than dental. Then their book would have been a really first-rate text-book for the medical student. As it stands it leaves him without direction in many important points. For example, he will find no help when he wants to know how to manage the anæsthetic for an operation for removal of tonsils and adenoids or the anæsthetic for excision of the thyroid in the toxic patient. Again he will look in vain for guidance in the management of patients who have to take anæsthetics for the relief of acute intestinal obstruction, a class who frequently need the help of practitioners who are not specialist anæsthetists. Nor is the student more fortunate if he seeks the pages of this book for instruction as to anæsthetics for abdominal operations generally, or for those on the upper abdomen in particular. Having thus pointed out what we consider the defects of the book, i.e. faults of omission, we may more happily turn to consider its high merits of commission. The history of anæsthetics is well summarized, though here too we think that to find no mention of the work of Paul Bert and of Frederic Hewitt in connexion with the employment of oxygen in anæsthetic practice should be remedied. The physiology and biochemistry of respiration are admirably done and so is the chapter on cyanosis.

The chapter on children is very good so far as dental anæsthetics are concerned, but hardly touches the subject on any other side. As regards status lymphaticus, while many anæsthetists will not agree with the authors' scepticism as to the reality of the condition all will support the statement that "It is our opinion that in deaths under anæsthesia the anæsthetist is more responsible than either the drug used or the pathological condition of the patient". Another way of putting this is that "anæsthetic deaths are preventable", and that is a slogan which should be constantly dinned into the ears of the student. There is an excellent chapter on ethyl chloride, but that devoted to vinesthene would not give the student any idea of its

value except as a short anæsthetic as in dentistry. The book is well produced and profusely supplied with excellent illustrations. We congratulate the authors on a production which will be of the highest value to any student or anæsthetist who desires proficiency in the practice of dental anæsthesia.

CORRESPONDENCE

To the Editor, *British Journal of Anæsthesia.*

R.A.M.C., MIDDLE EAST FORCE.

SIR,—Anæsthesia has always been the most neglected of all branches of medicine. Although the patient's comfort and even his very life may depend upon good anæsthesia, there are still far too many places where this fact is utterly ignored—where any old thing will do, provided that it is easy and cheap.

There are just a few places in the world (such as the University of Wisconsin) where real enthusiasm and encouragement exist. These have led to very great technical advances, such as the introduction of cyclopropane. Until recently, however, England—though perhaps possessing the highest average level of attainment—had no outstanding school, no Mecca to attract anæsthetists from other countries. That want has been supplied at Oxford by the generosity of Lord Nuffield, with the result that Oxford now compares favourably with the first-class American centres of anæsthesia research.

I am sorry to see that Cambridge, far from emulating the progressive and enlightened spirit of the rival institution, is proposing to take a retrograde step and institute that bane of the second-rate American medical school, the nurse-anæsthetist, which Canada has been wise enough to prohibit, after extensive trial. Not satisfied with ignoring modern progress (and the law relating to covering unqualified practice), Cambridge is to put the clock back and give up all hope of further advance.

There is a similar school of thought in India at the present time, a desire to abolish Western science and return to the era of the totem-pole and the medicine man; but I never expected that Cambridge would enter this unholy competition.

It is true that technicians can be trained to give anæs-

thetics competently by certain methods, but this does not make them into anæsthetists. Similarly, technicians could easily be trained to remove appendices, but that would not make them into surgeons.

What anæsthesia needs is not deliberate retrogression but deliberate encouragement, for there is far too much bad work done already, even by men capable of better things. I personally know of two recent cases where patients were killed by an experienced man simply because of this crazy surgical insistence on cheap anæsthesia, which is so widespread as to be almost universal.

If this proposal is adopted, I for one will cease to use certain Cambridge degrees which I previously thought to be of some value. I am not conceited enough to think that this will affect the University in any way, but it will at least clear my own conscience by dissociating me entirely from a reactionary policy which is in such striking contrast to the enlightened and progressive spirit of Oxford.

I am, Sir,

W. STANLEY SYKES
(Major, R.A.M.C.)

[We would point out that the action of Addenbrooke's Hospital is not the responsibility of the University of Cambridge.—EDITOR.]